Deep Learning on the Effects of Earthquake Loads on Steel and Reinforced Concrete Bridges = Deep Learning terhadap Dampak Beban Gempa pada Jembatan Baja dan Beton Bertulang

Dustin Mulyana, author

Abstrak

Studi ini mengevaluasi kinerja seismik dari dua struktur jembatan, yaitu jembatan baja dan beton bertulang tipe Super-T, menggunakan data gempa bumi nyata. Data diproses melalui kerangka kerja berbasis Python dengan memanfaatkan pustaka ObsPy. Sebanyak lima puluh rekaman gempa dari stasiun seismik AYR State High School di Queensland dianalisis, dengan riwayat waktu percepatan yang diseragamkan dalam durasi 10 detik. Dua metrik utama diekstraksi dari setiap kejadian: percepatan spektral puncak dan durasi guncangan signifikan. Input seismik kemudian diterapkan pada arah kritis masing-masing model jembatan melalui analisis riwayat waktu menggunakan perangkat lunak SPACE GASS. Hasil menunjukkan bahwa jembatan baja mengalami perpindahan puncak yang lebih besar (43 mm) dibandingkan dengan jembatan beton Super-T (26 mm), terutama karena tinggi dan konfigurasi strukturalnya. Meskipun baja memiliki sifat daktilitas yang tinggi, jembatan Super-T menunjukkan kinerja yang lebih baik secara keseluruhan terhadap kondisi gempa nyata yang diamati. Temuan ini menekankan pentingnya geometrik struktur, durasi guncangan, dan pemodelan berbasis data dalam evaluasi kerentanan seismik.
.....This study assessed the seismic performance of two bridge structures, a steel bridge and a Super-T reinforced concrete bridge using real earthquake ground motion data. This is processed through a Python-based framework by utilising the ObsPy library. Fifty earthquake records from the AYR State High School seismic station in Queensland were analysed with acceleration time histories extracted into uniform 10-second durations. The two key metrics, peak spectral acceleration and significant shaking duration were computed for each event. Time history analysis was conducted using SPACE GASS, applying the seismic inputs in the critical direction of each bridge model. Results showed that the steel bridge experienced greater peak displacement (43 mm) than the Super-T reinforced concrete bridge (26 mm), primarily due to its height and structural configuration. Despite steelâs characteristic ductility, the concrete model demonstrated better overall performance under the real-life seismic conditions obtained from the seismic station in Queensland. The study highlights the importance of structural geometry, duration of shaking, and data-driven modelling in accurate seismic vulnerability assessments.